

## **Salmonella in U.S. Cattle Feedlots**

*Salmonella* is a recognized pathogen that can cause substantial morbidity and mortality in cattle feedlots. *Salmonella* is also associated with foodborne illness in people.

In U.S. beef production, postharvest intervention strategies are aimed at lowering the occurrence of *Salmonella* and all foodborne pathogens in meat and meat products. Recently, however, interest has increased in examining preharvest strategies that could augment the effectiveness of postharvest strategies. A better understanding of *Salmonella*'s ecology in the feedlot production environment could help identify effective preharvest control strategies. One objective of the NAHMS Feedlot 2011 study was to describe the prevalence and antibiotic resistance of *Salmonella* found on U.S. cattle feedlots.

The NAHMS Feedlot 2011 study provided an in-depth look at large feedlots (1,000 or more head capacity) in 12 States<sup>1</sup> and small feedlots (fewer than 1,000 head capacity) in 13 States.<sup>2</sup> Large feedlots accounted for 82.1 percent of the January 1, 2011, inventory of cattle in all U.S. feedlots but only 2.8 percent of all feedlots. The 12 participating States accounted for over 95 percent of the cattle inventory in large feedlots (NASS "Cattle on Feed" report, February 18, 2011).

During the study, a subset of 68 large feedlots consented to *Salmonella* testing. On each of the 68 feedlots, 3 pens of cattle were identified for sampling: the pen that had been in the feedlot the shortest amount of time, the pen closest to harvest, and 1 pen selected at random. Up to 25 individual fecal samples were collected from each pen floor. The samples were cultured for *Salmonella*, and any *Salmonella* isolates were characterized by serogroup, serotype, and antimicrobial resistance profile. Up to four isolates were selected from each fecal sample for serogrouping; when isolates of different serogroups were detected in the same sample, a representative of each was retained for further characterization.

### **Prevalence of *Salmonella* in feedlots**

In total, 5,050 individual samples were collected from 202 pens in the 68 feedlots. Overall, 60.3 percent of the 68 feedlots had 1 or more samples test positive for *Salmonella*, and 35.6 percent of sampled pens were positive for *Salmonella*. There was no substantial difference in pen-level *Salmonella* prevalence based on the length of time cattle were in the feedlot. For pens of cattle that had been in the feedlot the shortest amount of time, *Salmonella* prevalence was 39.7 percent, compared with 33.3 percent of randomly selected pens and 33.8 percent of pens closest to harvest.

At the sample level, the overall prevalence was 9.1 percent. There was no substantial difference in sample-level prevalence based on pen type (time in feedlot). For pens in the early part of the feeding period, the sample-level prevalence was 8.5 percent compared with 9.0 percent for randomly selected pens and 9.8 percent for pens closest to harvest. A total of 571 *Salmonella* isolates from 460 positive samples were further characterized.

The three most common *Salmonella* serotypes isolated from the individual fecal samples (Anatum, Montevideo, and Kentucky) accounted for 50.4 percent of the total isolates (table 1). Each of the other serotypes identified represented less than 10 percent of isolates.

**Table 1. Number and percentage of isolates, by serotype**

<b>Serotype</b>	<b>Number</b>	<b>Percent isolates</b>
Anatum	103	18.0
Montevideo	98	17.2
Kentucky	87	15.2
Others	283	49.6
Total	571	100.0

<sup>1</sup> Arizona, California, Colorado, Idaho, Iowa, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, Washington

<sup>2</sup> Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, Ohio, Pennsylvania, South Dakota, Texas, Wisconsin

## Antimicrobial resistance of *Salmonella* isolates

Most *Salmonella* isolates (74.6 percent) were susceptible to all antimicrobial agents tested. When resistance was present it was usually to a single antibiotic (15.9 percent of isolates). Overall, less than 10 percent of isolates were resistant to each of the antimicrobial agents tested, with the exception of tetracycline (21.4 percent of isolates resistant) and sulfisoxazole (13.1 percent) [table 2].

**Table 2. Number and percentage of isolates resistant to the following antimicrobial agents**

Antimicrobial agent	Number resistant (n=571)	Percent resistant*
Amoxicillin clavulanic acid	44	7.7
Ampicillin	45	7.9
Cefoxitin	44	7.7
Ceftiofur	44	7.7
Ceftriaxone	44	7.7
Chloramphenicol	50	8.8
Ciprofloxacin	3	0.5
Gentamicin	0	0.0
Kanamycin	6	1.1
Nalidixic acid	6	1.1
Streptomycin	49	8.6
Sulfisoxazole	75	13.1
Tetracycline	122	21.4
Trimethoprim sulphamethoxazole	1	0.2

\*Resistance was determined using breakpoints reported in the 2011 National Antimicrobial Resistance Monitoring System (NARMS) report available at: <https://www.fda.gov/animal-veterinary/national-antimicrobial-resistance-monitoring-system/narms-2011-executive-report>

## Summary

*Salmonella* is an important animal health and foodborne pathogen. Based on the results of the Feedlot 2011 study, the overall prevalence of *Salmonella* cultured from fecal samples was 9.1 percent, with no differences by duration of the animals' stay in the feedlot. However, *Salmonella* was widely distributed, with 35.6 percent of pens and 60.3 percent of feedlots having at least one positive sample. Most of the *Salmonella* isolates (50.4 percent) were attributable to three serotypes. Overall, most *Salmonella* isolates were susceptible to all antimicrobial agents tested. When

resistance was present it was most commonly to tetracycline (21.4 percent of isolates) or sulfisoxazole (13.1 percent of isolates). The overall prevalence of *Salmonella* reported in the Feedlot 2011 study is similar to the prevalence found during the NAHMS Feedlot '99 study in which 6.3 percent of samples tested positive for *Salmonella*.

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